

**Abstract**

A system and method for desalinating a feed solution containing a high level of sparingly soluble solutes, such as calcium sulfate, in which a high percentage of the water content of the feed solution is recovered as purified water. The method and system comprise introducing a sufficient quantity of nucleation crystals on the low pressure side of a first-pass membrane separation unit so that the sparingly soluble solutes precipitate on the suspended nucleation crystals, instead of on the surface of the first-pass semi-permeable membrane barrier. The permeate from the first-pass membrane separation unit is then sent to the high pressure side of a second-pass membrane separation unit. The second-pass semi-permeable membrane barrier rejects additional dissolved solutes, some of which can be recycled back to the first-pass membrane, so that permeate with a low level of dissolved solutes is produced on the low pressure side of the second-pass membrane barrier.